cellular companies, and the appropriate framework for pioneer preferences. I spoke at the FCC Task Force meeting on PCS held on April 11, 1994. I also have done significant academic research in mobile telecommunications and it is one of the primary topics in my graduate course, "Competition in Telecommunications", which I teach each year at MIT.

I. Summary and Conclusions

6. The NPRM bases its interconnection proposal on the principle of mutual traffic exchange, also known as Bill and Keep. The proposal is essentially a non-economic approach to the question of appropriate charges for interconnection. If adopted, the proposal would have two harmful economic consequences: (1) since the economic cost of interconnection would not be reflected appropriately in the price of interconnection, economic efficiency would be lost as companies make non-cost based choices and (2) CMRS providers would be permitted to free ride off the investment made in existing networks by LECs and by other carriers. This free riding will create adverse incentives for future investment in telecommunications networks.

7. The Commission's Bill and Keep proposal will create free riding incentives for new entrants. LECs have invested billions of dollars in their existing networks. They can only recover their investments if they are paid prices for the use of their networks which reflect the economic costs associated with network usage. The Commission's proposal does not take account of the economic costs, but the proposal instead creates an incentive for the new CMRS entrant to minimize its cost while taking advantage of the existing networks and not paying for usage. Not taking account of all economic costs results in market failure. Market failure will cause underinvestment in networks in the future because companies will understand that the market failure will not allow them to recover their economic costs.

8. Bill and Keep might be approximately correct if both of two circumstances are satisfied: (1) approximately equal traffic flows in both directions and (2) approximately equal costs of interconnection. Neither condition is satisfied in the situation considered here for PCS (and CMRS) providers. Thus, economic inefficiency and distortions will be the result.

9. The first principle of an economic approach to interconnection charges is mutual compensation. The basic economic principle is that since interconnection causes a company to incur costs, the company should be compensated for its expenditure. Otherwise, a competitor will not necessarily make the economically efficient investment decision, but it instead will attempt to use an existing network to minimize its own costs while causing the existing network to incur greater costs. The other main principle of an economic approach to interconnection should be the goal of economic efficiency. Economic efficiency requires that goods and services be produced in the least cost manner.

10. The best economic policy for interconnection is to allow parties to negotiate to see if they can arrive at a mutually agreeable interconnection arrangement. Such an agreement is likely to encourage an economically efficient and technically flexible solution which will benefit both companies' customers.

11. In an interconnection framework without regulatory distortions which attains an economically efficient outcome, economic theory leads to the conclusion that interconnection rates should be based on long-run incremental cost. Interconnection is an intermediate good. If prices for an intermediate good (or input of production) exceed costs, the user of the intermediate good will tend to shift to a lower priced, but potentially higher cost, input because the price is lower. However, economic efficiency indicates that the lowest cost input should be used, or society's resources are wasted. Thus,

long run incremental cost provides the correct economic basis on which to set interconnection rates so long as other regulatory distortions do not prevent the achievement of economic efficiency.

12. However, there are numerous regulatory distortions and other economic factors that mitigate against applying this economic theory to interconnection pricing. First, numerous regulatory distortions exist because different types of networks, e.g. IXCs, ESPs, wireless, are each subject to different regulatory and pricing rules for interconnection. Market forces alone do not determine the prices or terms and conditions for any of them. Second, LECs are multi-product firms with economies of scale and scope which results in fixed and common costs arising from network investment. These costs need to be recovered for a LEC to continue to invest in its network and stay in business. Current regulatory policy does not permit these costs to be recovered in an economically efficient manner. Third, recovery of these costs is also significantly complicated by state and federal regulation of the different services which create additional regulatory distortions. Thus, until these regulatory distortions are eliminated and cross subsidization of services caused by regulation is eliminated, it would be inappropriate regulatory policy and incorrect economics to apply interconnection set at long run incremental cost because of the significant regulatory arbitrage which would be created and because a significant source of contribution of fixed and common costs would not be replaced by an alternative source.

13. A coordinated policy at both the federal and state level is required which would reduce interconnection prices toward long run incremental costs as similar services are also reduced toward their long run incremental costs, and alternative sources for recovery of fixed and common costs are established to replace the lost contribution from current interconnection prices. This overall policy reform would lead to large gains in both consumer welfare and economic efficiency for the U.S. economy.

I. Bill and Keep is Misguided Economic and Regulatory Policy

14. The most fundamental rule of the economics of a market economy is that an individual or firm should pay for the economic costs created by its economic activity. In a competitive market economy when Jane Smith buys a new suit, she pays for the cost of the suit. When Compaq computer buys a DRAM from Micron, it pays for the economic cost of the DRAM.[1] Price equal to cost is the outcome of a competitive economy. A market failure occurs when price equal to cost does not occur. One of the main causes of market failure is externalities. As explained in Nobel Prize winner Paul Samuelson's textbook:

> "Externalities...occur when firms or people impose costs or benefits on others without those others receiving the proper payment or paying the proper costs." (P.A. Samuelson and W.D. Nordhaus, Economics, (McGraw Hill, 12th ed., 1985, p. 48)

Professor Samuelson goes on to state that an important role for government may occur in this situation:

> "A market failure leads to inefficient production or consumption, and there may be a role for government to cure the disease". (ibid., emphasis in the original)

The proposed Commission policy of "bill and keep" for PCS (and perhaps other CMRS) providers will cause a market failure, rather than correct a market failure. Thus, a bill and keep policy is misguided economic and regulatory policy. The Commission has often stated that an important goal is to have telecommunications operate in a competitive manner (e.g. NPRM, ¶ 6). Creating market failures is the opposite of the outcome of the competitive process. The Commission has also stated that an important goal is to have telecommunications provided in an economically efficient manner (e.g. NPRM, ¶ 4). Creating market failures decreases economic efficiency, in general.

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[1] Note that price could well exceed marginal cost for the DRAM because Micron needs to cover its fixed costs, e.g. R&D. Similarly, LECs have fixed and common costs which require prices services above long run incremental (marginal) cost.

A. The Importance of Economic Efficiency

15. Another often stated goal of the Commission is economic efficiency. All economists agree that economic efficiency is important. Again to quote Professor Samuelson:

"Efficiency is a central (perhaps the central) concern in economics. Efficiency means there is no waste." (ibid., p. 28)

Economic efficiency is the central maxim of economics because it leads to the best use of society's resources--the costs of production for a given level of output are at a minimum level.[2] Costs reach a minimum when the seller wants to produce the good or service at minimum cost while the buyers wants to cause the minimum cost so that price will be low. The market economy provides economic incentives which lead to minimum cost and an economic efficient outcome. Bill and Keep destroys these economic incentives and will lead to economic inefficiency.

16. The reason that Bill and Keep destroys the correct economic incentives is that it makes interconnection "free", i.e. zero price, to the PCS provider. Thus the PCS (or CMRS) provider has no economic incentive to use the least cost, most economically efficient, alternative. The PCS provider will choose the least cost alternative to itself, but this alternative may create large costs for the interconnecting LEC.[3] If cost based prices are used for interconnection instead of free interconnection, the PCS provider has an economic incentive to consider the LECs costs through the price signal it receives. With no price signal available, no reason exists for the minimum

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[2] The NPRM also states the goal of "lowest overall cost", p. 4.

[3] Professor Brock makes an error in his economic reasoning when he claims that an advantage of Bill and Keep is that each company has an incentive to reduce its costs. (G. Brock, "Interconnection and Mutual Compensation with Partial Competition", undated, p. 13) He forgets to take account of the additional cost that the sender of traffic imposes on the receiver of the traffic by its cost minimizing policy. This additional cost creates the externality which leads to the market failure and the loss in economic efficiency. Thus, Professor Brock fails to account for the externality aspect of networks which is an essential feature of networks as economists have long realized.

total cost, economically efficient alternative, to be the outcome. The Bill and Keep will lead to a waste of society's resources which is among the worst possible outcomes of government policy.

17. From the LEC viewpoint under a Bill and Keep policy, it has no incentive to offer more interconnection choices because it is not receiving its costs back. Instead, the LEC will have the incentive to offer only the types of interconnection with the lowest cost to itself. PCS providers will inevitably complain that they are not receiving enough choices of different types of interconnection, and a regulatory wrangle will ensue. Again resources will be wasted because other types of interconnection which create lower costs for the PCS provider, and perhaps lower total costs, will not be available.

B. Free Riding

18. Bill and Keep is also a classic example of free riding. Free riding occurs when one party uses an investment by another party without paying for it. The Commission's Bill and Keep proposal will create free riding incentives for new entrants. LECs and cellular companies have each invested in the tens of millions and up to billions of dollars in their existing networks. They can only recover their investments if they are paid prices for the use of their networks which reflect the economic costs associated with network usage. The Commission's proposal does not take account of the economic costs, but the proposal instead creates an incentive for the new CMRS entrant to minimize its cost while taking advantage of the existing networks and not paying for usage. Not taking account of all economic costs results in market failure; this situation is known as the externality problem in economics and is one of the most important causes of market failure as I discussed above. Market failure will cause underinvestment in networks in the future because companies will understand that the market failure will not allow them to recover their economic costs.

19. Decreased investment in networks will cause less choice for businesses and consumers as well as decreased economic welfare. Companies will not invest in the most modern telecommunications networks. Free riding inevitably has this outcome. New entrants should pay their full economic costs so that market failure does not occur. Markets work properly when prices reflect economic costs. The Commission should attempt to design interconnection arrangements so that prices and costs lead to economic efficient outcomes.

C. Regulatory Maneuvering and Arbitrage

20. Bill and Keep creates perverse economic incentives for regulatory maneuvering and arbitrage. While the NPRM discusses Bill and Keep as an "interim solution" (¶ 3, ¶ 59-60), once established Bill and Keep gives the recipients of the subsidy reason to fight against its removal. Thus, the Commission creates an interest group directly opposed to the goal of cost based prices and economic efficiency. Given the recent history of Commission policy and telecommunications reform in the U.S. where interest groups have successfully limited the adoption of economically efficient proposals such as the Subscriber Line Charge (SLC or EUCL), the explicit creation of another interest group with a direct economic incentive to oppose an economically efficient policy, cost based rates, seems to point telecommunications policy in the wrong direction.

21. Potentially even more important, Bill and Keep creates a significant loophole for potential regulatory arbitrage. Sprint has announced construction of a nationwide PCS network and AT&T will have a combined national PCS and cellular network. Both of these companies could switch significant amounts of their mobile or even landline long distance traffic to their PCS and cellular switches (MTSOs), and then terminate the traffic for free on the LEC network. These companies would thus avoid paying terminating access fees. Given the significant percentage of costs that access creates

for IXCs, this strategy would be very attractive and would be a devastating outcome for the LECs. Note that the strategy would not use any airtime or spectrum which is the scarce resource, but would only need a mobile switch to interconnect the traffic to the LEC network.

22. This type of regulatory arbitrage is not merely a hypothetical example. Similar strategies have long been used for "rate shopping" when prices diverged for high cap (DS-1) lines and state and federal tariffs differed. Indeed, in competitive markets because of arbitrage there tends to be at any one time and place a single prevailing price. Taken to the arbitrage limit, the single price for access and interconnection will be zero under Bill and Keep. While I would not expect this outcome to occur because of regulatory restrictions, the arbitrage limit highlights the economic incentives that create significant economic distortions under a Bill and Keep policy.

23. The significant likelihood of regulatory arbitrage demonstrates the difficulty of setting a CMRS interconnection policy without revising the Commission's switched access policy. Interconnection is very similar technologically to switched access which is priced well above cost.[4] If interconnection is provided for "free", large economic incentives arise to convert switched access to interconnection. The possibility of regulatory arbitrage and its extremely large affect on LECs, given their current dependence on switched access revenues, leads me to recommend that the Commission should adopt a CMRS interconnection policy and revise its switched access policy to make them consistent with each other. The possibility of regulatory arbitrage will be reduced, and regulatory policy will permit competition among CMRS and long distance providers to occur on the relevant economics, not on artificial regulatory distinctions. However, until these changes occur across the board, CMRS interconnection should be priced above

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[4] This statement follows for Zone 1, but not in Zones 2 and 3.

long run incremental cost to avoid regulatory arbitrage, and the LECs should have price flexibility to respond to competitors' prices.[5]

D. Subsidies Create Competitive Problems

24. The history of FCC regulation of LECs demonstrates that subsidies create competitive problems. Bill and Keep presents the ultimate cross subsidy framework since the PCS providers pay a zero price for the service. The Commission faces the current problem of access rates well above cost together with the bypass problems which this system creates. The cross subsidy inherent in the access framework leads to significant losses to the U.S. economy--well above $1 billion per year according to my research.[6] Access reform is an important issue for telecommunications policy.

25. It would be extremely poor economic policy to create a new subsidy system under any circumstances. However, for PCS providers no supporting rationale, such as universal service, exists for the subsidy. The entry decisions of PCS providers such as AT&T, Sprint, or the RBOCs will not be affected by a cost based interconnection. They have committed themselves to building a PCS network. If the Commission feels that PCS needs a subsidy to compete, the market will already reflect the required size of the subsidy by the lower auction values of spectrum. A subsidy beyond the auction value is a transfer from LEC stockholders to PCS provider stockholders. I fail to understand any rationale for this transfer which would be created by Commission policy.

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[5] I have discussed the economic reasons for permitting price flexibility in previous submissions to the Commission. See e.g. Statement of Jerry Hausman (December 6, 1995, ¶ 10-13) and Reply Statement of Jerry Hausman (January 9, 1996, ¶ 3-15) submitted in response to the FCC's Second Further Notice of Proposed Rulemaking, CC Docket No. 94-1, FCC 95-393. (Second Notice)

[6] J. Hausman, "Proliferation of Networks in Telecommunications", ed. D. Alexander and W. Sichel, Networks, Infrastructure, and the New Task for Regulation (Univ. of Michigan Press, 1995).

III. Economic Rationales Offered for Bill and Keep are Incorrect or Inapplicable to the Current Situation

26. Bill and Keep might be approximately correct if both of two circumstances are satisfied: (1) approximately equal traffic flows in both directions and (2) approximately equal costs of interconnection. Neither condition is satisfied in the situation considered here of PCS (and CMRS) providers. Thus, economic inefficiency and distortions of the type I discussed above will be the result. Only, if the costs approximately offset each other would the resulting situation be approximately all right; that situation does not occur here.

A. Traffic Flows are Likely to Be Very Unequal

27. Currently, terminating cellular calls on the landline network outnumber originating calls from the landline network to cellular by a ratio of approximately 4 to 1. Pacific Bell's most recent data have 80% of cellular calls involving its network terminating on the Pacific Bell network, while only 20% of calls are landline to cellular. Thus, even if the costs of interconnection were equal, PCS (and other CMRS) providers would create a cost approximately 4 times larger than the costs created by landline originating calls. This large subsidy from the landline network to PCS providers has no economic reason for its existence.

28. While current policies of cellular providers and landline providers may contribute partly to the traffic imbalance, it is unlikely to change significantly in the near future. Mobile calls are made by individuals "on the move" who often are returning previous calls while driving, walking or taking public transportation. Many individuals do not keep their cellular telephones turned on because of the inconvenience of taking calls when engaged in other activities and the significantly higher costs of these calls. Thus, I expect significantly more calls to terminate on the landline network for the foreseeable future.

B. Professor Brock's Metering Analysis Is Incorrect

29. Prof. Brock in his paper gives two main arguments for Bill and Keep. The first argument is the approximately equal traffic argument which surely does not come close to holding in the PCS and CMRS situation of interconnection.[7] However, he puts forward another argument of high metering costs which is also incorrect. Professor Brock has inadvertently slipped back to rate of return (ROR) regulation rather than recognizing the altogether different incentives present under the current price cap system of regulation. Price caps change the correct economic policy.

30. Under ROR regulation the regulator offered the LEC the ability to earn a given rate of return on its undepreciated assets as computed in the regulatory rate base. Thus, under ROR regulation the net revenue (or contribution) after metering would be the focus of the regulation. This net revenue would be added to other sources of contribution to yield an expected rate of return set by a cost of capital calculation.

31. Under price cap regulation, no rate of return is specified. Here Commission policy should be to set the correct cost based rates for interconnection. The LEC can then decide if metering costs are too high to make charging the Commission approved rates economical. If metering costs are too high during certain periods of the day (or overall), the LEC will not charge for interconnection during these periods. Price caps allow the LEC to make the profit (market) determined decision, rather than the regulator attempting to determine what the LECs decision should be. The market, rather than a regulator, can then decide the relationship of metering costs to the interconnection costs and charges.

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[7] Pacific Bell estimates that the ratio of terminating cellular calls to originating cellular calls exceeds 4 to 1.

C. Metering Costs are Unlikely to Be Too High Relative to Interconnection Costs

32. However, metering costs are likely to be considerably lower than the costs of interconnection, especially during peak periods. Costs developed by Pacific Telesis with the methodology explained in the accompanying report by Drs. Tardiff and Emmerson indicate that 24 hour average LRIC for Feature Group B termination is approximately $0.0062 per minute while peak costs for interconnection are approximately five times this amount.[8] Furthermore, I expect large increases in PCS and other CMRS interconnection traffic since it is growing at the rate of 40% per year, with even higher growth rates with new CMRS providers beginning operation. Thus, "excess capacity" formerly available from the fill engineered into the landline networks will be expended quickly with a likely increase over time in interconnection costs. No reason exists to believe that the costs of interconnection are negligible compared to the costs of metering.

33. Furthermore, the costs of metering are quite low since it is already done (except for local calls from flat rated residential customers) and the LECs have systems in place already. Thus, the sunk costs of software development have already occurred so that the incremental cost of metering is quite low. It is the incremental forward looking costs of metering which should be compared to the incremental forward looking costs of interconnection. However, as I discussed above, the LEC is best placed to make this decision once the cost based interconnection charges are set.[9]

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[8] Feature Group B switched access most closely approximates CMRS interconnection arrangements. Of course, these LRIC estimates do not include fixed and common costs.

[9] An important point is that private negotiations may lead to a superior solution here. I discuss reasons to allow private negotiations below. Each party may take part in all or part of the metering costs depending on the least cost solution. A private bargain can allow this least cost solution to occur with the parties sharing in the cost savings which arise.

D. Professor Brock's Reliance on the RAND Study Is Incorrect

34. Prof. Brock (and the NPRM, ¶ 61, fn. 78) cites the RAND study for long run incremental costs of interconnection. This reliance is misplaced. The RAND study stated explicitly (p.1) that its goal was only to develop a correct cost methodology and to provide "initial estimates". These initial estimates are based on 1987 data which is now 9 years old and the RAND study notes the importance of continual technological change in the local network.[10] (p. 6) Indeed, the RAND study leaves out certain network components, e.g. increased fiber capacity and the associated electronics, in developing its methodological approach.[11] The RAND study explicitly states it leaves out cost elements of the network (Table 19, p. 75). For these reasons the RAND study was explicitly not used in the California Public Utility Commissions proceedings which took place in 1991-92 in which I helped develop long run incremental cost numbers for Pacific Bell. Pacific Bell has further refined its costs numbers, which I refer to above in paragraph 33, and these cost numbers should be the basis of Commission policy, rather than the 9 year old incomplete cost numbers developed in the RAND study and cited by Professor Brock.

E. An "Infant Industry" Approach is Not Appropriate

35. While the NPRM does not make an explicit infant industry argument, implicit in the Bill and Keep proposal is the claim that PCS needs a subsidy from the LECs to prosper. This claim is incorrect. Large and sophisticated companies such as AT&T, AirTouch, Sprint, and LECs who provide cellular have

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[10] For instance, the RAND study fails to account for the rapidly decreasing prices for switching and other electronic equipment (i.e. shorter economic lives) which increase the cost of capital for telecommunications equipment. These rapid price decreases began to occur around the time of the RAND study period, 1987.

[11] See RAND study, Section IV, pp. 38-41, where the assumptions are noted. This omission could be potentially important because under a zero charge Bill and Keep policy the CMRS provider will minimize its own costs by terminating calls at the nearest end office. This strategy will lead to a significant increase in peak period interoffice transport for the LEC.

already paid in excess of $7 billion for their PCS spectrum. These large companies have already made their entry decision so that the level of the interconnection charge will not affect this decision. These future PCS providers certainly do not require a subsidy from the LECs to be able to compete with cellular and with the LECs in the future.

36. Thus, future competition will not be increased by the subsidy, apart from the effects of the subsidy favoring one group of providers and penalizing another. Taxes and subsidies should not be used to favor one industry over another industry. Instead, each industry should be able to use its competitive advantages to offer consumers choices of services and products. No reason exists to favor new PCS providers who have already demonstrated that they believe they can successfully compete.

37. Another danger exists that cellular carriers will next claim that if PCS receives an interconnection subsidy through Bill and Keep then cellular should receive the same subsidy under the regulatory parity principle for CMRS of recent Congressional legislation. Whatever one believes about cellular, and I have previously submitted affidavits on behalf of cellular carriers to the Commission, no one can claim that cellular carriers are not sufficiently profitable so that a cost based interconnection charge will curtail their ability to compete or their ability to make further investments in their networks. Cellular is the success story of telecommunication in the 1990's and should pay for costs it causes for landline networks.

F. Commission Policy Should Reflect Current Regulatory Realities

38. LECs currently use the interconnection charges from cellular as contributions to help fund their fixed and common costs. Loss of this contribution would need to be made up. Current contracts between LECs and cellular companies should be allowed to remain in force until regulatory policy and negotiating parties adopt a consistent interconnection and access

policy based on mutual compensation.

39. The Commission states in the NPRM that the LECs could still charge their final terminating customers even if a Bill and Keep policy were used. This statement is correct theoretically, but based on current regulation the LECs would need regulatory permission to charge final customers for the call. For instance, Pacific Bell would need CPUC permission before they could charge their landline customers additional charges for calls placed to mobile telephones. Regulatory permission would need to arise from the state PUCs and would inevitably lead to regulatory arguments. Therefore, it is unreasonable to expect such state commission approval could occur quickly enough to begin offsetting the revenue loss that would result from the Commission's proposed intent to implement Bill and Keep immediately.

40. My understanding is that Pacific Bell is recommending mutual compensation for CMRS interconnection and expects to request the CPUC to approve new charges to land line end users calling wireless users, in order to recover the new costs imposed on Pacific Bell by wireless providers for termination of calls on their networks. The effect of this approach is substantially different than the Bill and Keep policy proposed by the Commission, in which the Commission states that LECs could recover their interconnection costs from end users. The amount of additional charges to land line callers with mutual compensation is considerably lower than with Bill and Keep. This outcome occurs because under Bill and Keep all of the LECs' interconnection costs would be recovered from its end users, while under mutual compensation LEC interconnection costs for mobile to land (about 80% of the usage) would be recovered from wireless providers. Additionally, since Pacific Bell intends to provide mutual compensation for the new interconnection contracts when the current contracts expire in Spring 1997, there is more time for Pacific Bell to work with the CPUC and other parties to gain approval for the additional charges to land line callers.

IV. Mutual Compensation and Economic Efficiency

41. The first principle of an economic approach to interconnection charges is mutual compensation. The basic economic principle is that since interconnection causes a company to incur costs, the company should be compensated for its expenditure. Otherwise, a competitor will not necessarily make the economically efficient investment decision, but it instead will attempt to use an existing network to minimize its own costs while causing the existing network to incur greater costs.

42. The other main principle of an economic approach to interconnection should be the goal of economic efficiency. Economic efficiency requires that goods and services be produced in the least cost manner. Otherwise, society's resources are wasted. This principle, called productive economic efficiency, is widely recognized among economists and the Commission has recognized its importance previously. The Commission fails to recognize that the principle of productive economic efficiency will be violated by its proposal. Cost based prices are necessary so that both the seller and the buyer of a service will make the economically efficient choice.

43. For instance, a CMRS provider will decide whether to use Type 1 interconnection or Type 2 interconnection depending in part on the rates for interconnection as well as the rates charged by the LEC or a competing CAP for the use of other facilities such as private lines.[12] A CMRS provider would also take into consideration the cost of microwave capacity to send its traffic.[13] Note that under the Bill and Keep proposal since the CMRS provider does not have to pay the LEC for interconnection, the CMRS will disregard the interconnection rates. The CMRS provider could then choose a

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[12] Type 1 interconnection occurs at a LEC's end office while Type 2 interconnection is interconnection at a tandem switch.

[13] These statements are based on the current economic actions of cellular providers whom I have consulted for.

form of interconnection which created lower costs for it, but would likely create higher costs for the LEC. On balance, the combined overall costs of the CMRS provider and the LEC could well be higher. The result would be economic inefficiency and a waste of society's resources.

44. Consider the question of interconnection from the other side, the LEC's viewpoint. If the LEC is not permitted to charge the CMRS provider for interconnection, the LEC might well decide that they will offer fewer types of interconnection because it leads to lower overall costs for the LEC. The CMRS provider may no longer have a choice of the type of interconnection which is best from a cost basis and from a competitive basis. Again, the combined costs of the CMRS provider and the LEC could well be higher than in the case when the CMRS provider has the ability to choose the type of interconnection which is best. These examples demonstrate why prices are necessary to ensure an economically efficient allocation of economic resources. Non-price systems as proposed by Commission in the NPRM have been tried and found to create large amounts of economic inefficiency in Eastern Europe and the former Soviet Union.

A. Interconnection Charges Should be Cost Based with Choices Offered

45. Interconnection charges should be cost based to ensure economic efficiency. Choices should be offered by the LECs with prices for different types of interconnection set to reflect costs. The buyer of interconnection can then choose the type of interconnection which best meets its service offerings as well as to choose the least cost alternative. The different prices will reflect the costs caused by the interconnection to the LEC which provides interconnection. The LEC will then have the economic incentive to provide choices rather than offering only the type of interconnection which minimizes the LEC's costs. An economically efficient outcome will be the result.

46. Indeed, I recommend that LECs should offer interconnection at any mutually agreeable feasible point with the price for each type of interconnection cost based. No restriction on competition will occur, and the CMRS provider can choose the best type of interconnection given its business strategy. The LEC will also not be asked to subsidize the CMRS provider, but it will receive payment for costs caused by the interconnection.

B. Negotiations Between the Parties to Set Interconnection Rates is Preferable

47. Parties should be able to negotiate interconnection agreements privately with regulatory action needed only if the parties cannot agree. Parties know their own needs better than the regulatory process can discover, and individual parties are more flexible than regulation. Thus, they can come to an agreement which makes both parties better off than the outcome of the regulatory process.

48. The optimal economic policy for interconnection is to allow parties to negotiate to see if they can arrive at a mutually agreeable interconnection arrangement. Such an agreement is likely to encourage an economically efficient and technically flexible solution which will benefit both companies' customers. The regulator could still retain the authority to give final approval to an interconnection agreement in order to verify that it was pro-consumer. However, the regulator should set the terms for interconnection only if the two companies cannot come to an agreement. Lack of agreement will require an arbitrator, and the regulator is capable of fulfilling that role. However, agreement between the parties leads to a better economic outcome in almost all circumstances, as the parties' market action of agreeing demonstrates. The only circumstances where the regulator could be concerned about a private agreement occur when market power could be created or increased by a private agreement. Since CMRS providers will not have market

power, this possible outcome is not relevant.[14] Thus, the regulator should allow parties to attempt to reach agreement; if this attempt fails, the regulator can then set interconnection rates using the economic principles that I discussed above.

49. If the PCS provider feels that the LEC is using its possible market power, it can turn to the regulator to arbitrate an agreement. Once the principle of interconnection with mutual compensation is established, both parties will find it in their best interests to negotiate a solution without involving the regulatory process.

50. This system of private negotiation is in accordance with the often cited desire of the FCC to let the market work where possible. This market based solution with regulatory backup if necessary has been adopted by a number of foreign countries, e.g. Australia and the UK, by a number of states, and now by Congress in the Telecommunications Act. It is also the process which has taken place in cellular, to a large extent. A market outcome should be the goal of a mutual compensation interconnection policy since both parties have an economic incentive to reach an efficient agreement.

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[14] The NPRM speculates that a LEC and CMRS provider might "engage in collusive behavior" over interconnection prices. (¶ 90) This speculation is ill-founded because there will be many competing CMRS providers, not a single CMRS provider as the example would require. Furthermore, PCS providers are unlikely to reach an oligopoly outcome with cellular providers. However, if they wanted to do so, they would not need the LEC to cause CMRS prices to be higher than competitive levels. The Commission has previously found that with the introduction of PCS, competition will be significant.

V. Economic Analysis of Interconnection

51. Economic theory leads to the conclusion that to achieve an economically efficient outcome if no regulatory distortions are present, interconnection rates should be based on long-run incremental cost.[15] Interconnection is an intermediate good. If prices for an intermediate good (or input of production) exceed costs, the user of the intermediate good will tend to shift to a lower-priced, but potentially higher-cost, input because the price is lower. However, economic efficiency indicates that the lowest cost input should be used, or society's resources are wasted.[16] This loss of production efficiency is an aspect of the overall loss in economic efficiency that occurs if interconnection rates are not guided by principles of incremental cost. However, this economically efficient outcome will not be achieved if other regulatory distortions exist.

52. However, there are numerous regulatory distortions and other economic factors that mitigate against applying this economic theory to interconnection pricing. First, numerous regulatory distortions exist because different types of networks, e.g. IXCs, ESPs, wireless, are each subject to different regulatory and pricing rules for interconnection. Market forces alone do not determine the prices or terms and conditions for any of them. Second, LECs are multi-product firms with economies of scale and scope which results in fixed and common costs arising from network investment. These

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[15] My understanding of the recently signed Telecommunications Bill is that it calls for mutual compensation between carriers for terminating calls. The legislation provides that compensation should be based on a reasonable approximation of the additional costs of terminating such calls.

[16] Another way to consider the problem of regulatory price setting for access charges relates to the first type of economic efficiency discussed above - productive economic efficiency. P. Samuelson: "Efficiency means there is no waste". I discuss this issue in more detail in J. Hausman, "Proliferation of Networks in Telecommunications", ed. D. Alexander and W. Sichel, Networks, Infrastructure, and the New Task for Regulation (Univ. of Michigan Press, 1995). For a theoretical treatment of the need for productive economic efficiency see P.A. Diamond and J.A. Mirrlees, "Optimal Taxation and Public Production, I: Production Efficiency", American Economic Review, Vol. 61, 1971.

costs need to be recovered for a LEC to continue to invest in its network. Current regulatory policy does not permit these costs to be recovered in an economically efficient manner. Third, recovery of these costs is also significantly complicated by state and federal regulation of the different services which create additional regulatory distortions. Thus, until these regulatory distortions are eliminated and cross subsidization of services caused by regulation is eliminated, it would be inappropriate regulatory policy and incorrect economics to apply interconnection set at long run incremental cost because of the significant regulatory arbitrage which would be created and because a significant source of contribution of fixed and common costs would not be replaced by an alternative source.

A. Contribution to Fixed and Common Costs

53. The NPRM correctly notes that if all prices are set at LRIC that total costs will not be recovered because of fixed and common costs which arise from network economies of scale and scope.[17] Thus, the LECs still need a contribution source to help pay for the fixed and common costs. Economic analysis demonstrates that you should tax final goods and services, not intermediate goods. Thus, the Commission could possibly use an ad valorem tax on all final telecommunications services. I have previously put forward this proposal to state regulators who have adopted it to help fund lifeline and high cost subsidies. It provides a contribution source in a straightforward manner with low administrative costs and relatively low decreases in allocative economic efficiency. LECs, must cover their fixed and common costs, similar to my example of Micron producing DRAMS which I discussed in paragraph 14 above. Until a co-ordinated policy across different types of interconnection and at the federal and state level is adopted, an ad valorem tax provides a simple, low cost method to provide contribution for fixed and common costs.

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[17] Pacific Bell estimates that fixed and common costs are approximately the same size as the combined LRICs of all of its services.

54. If the Commission decides that an ad valorem tax on all final telecommunications services is not preferable, it can permit marking up the interconnection costs to determine interconnection rates for different types of interconnection to provide contribution for fixed and common costs. Economic analysis demonstrates that the rates should be based on the LRICs of the different types of interconnection for the reasons that I discussed above. However, the Commission should be extremely careful to minimize the potential for regulatory arbitrage which I discussed above. While economic analysis leads to the conclusion that a tax on all telecommunications services is a better option, interconnection rates based on LRICs, but priced above LRICs, do attain the fundamental economic principal of cost causation, and cost differences among different types of interconnection will be reflected in the interconnection rates which provide cost based signals to CMRS providers.

55. The Commission should realize that a tax only on the LECs, such as Bill and Keep proposes, is not competitively sustainable. The LECs will be forced to raise prices on other services where they face increasing competition. The LECs will lose demand for these services because of the increased prices which will make them even less competitive. Such a policy will lead in economic inefficiency, e.g. inefficient bypass, because although the LECs will be the low cost provider for certain services, the tax will cause a loss in demand to higher cost providers. An ad valorem tax removes this source of economic inefficiency. The ad valorem tax causes productive economic efficiency to occur which will lead to lower losses in economic efficiency than other proposals to fund fixed and common costs.

B. Peak and Offpeak Interconnection Charges

56. As I discussed before under a price caps approach, if interconnection charges are set at LRIC or above LRIC to provide a contribution for fixed and common costs, the LEC can decide whether it is worthwhile to undergo the metering costs. Given the relative size of peak

costs and metering costs, I expect LECs to charge for interconnection. Now if variable costs were actually zero offpeak, then the offpeak LRIC would be zero so the correct outcome would occur with no offpeak pricing. However, offpeak interconnection costs are not zero so that the LEC would likely decide to charge for offpeak interconnection. I do not see economic reasons not to have separate peak and offpeak charges, apart from measurement and administrative problems. If a peak period is considered necessary, a sufficiently long peak period to encompass actual peak calls and traffic shifting would be best.

C. Overall Access Reform

57. As the NPRM notes, interconnection regulation is really part of overall access reform. Interconnection is another form of network access which is becoming increasingly important as I discuss in my recent paper, "The Proliferation of Networks in Telecommunications" (op. cit.). The need to reform access is widely recognized, and the correct answer from an economic efficiency point of view, if the market is without regulatory distortions, is to set access charges to LRIC. However, given the large source of contribution to fund fixed and common costs of LEC networks as well as subsidies to residential customers, access reform will be required to replace these lost contributions. As I discuss in the paper, SLC reform would solve the entire problem. Increases in the SLC lead to almost no losses in economic efficiency and actually will lead to gains in economic efficiency because of lower long distance prices.[18] However, until SLC increases are approved, access reform and interconnection pricing must reflect both market realities and the LECs dependence of these contributions sources for recovery of fixed and common costs.

58. The problem of access and interconnection will only increase in the future with the "networks of networks" outcome which I discuss in my paper.

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[18] See J. Hausman, T. Tardiff, and A. Belinfante, "The Effects of the Breakup of AT&T on Telephone Penetration", American Economic Review, 1993, for a discussion of these issues and the needed elasticity estimates.

The increased proliferation of networks will lead to one call travelling over 3,4,or 5 or more networks. Telecommunications policy must have an economic approach to this situation or the current system of subsidies and taxes will create large economic distortions which will adversely affect competition. Regulatory arbitrage will increase and the Commission will be attempting to put its finger in a dike where increasing number of leaks appear. Internet long distance which escapes access charges is only the beginning of what can be expected in the future. A rational cost based system of charges avoids these problems because users pay the economic costs that they create. Such an outcome leads to economic efficiency and minimizes the regulatory problems that increased competition will create.

VI. The Future Success of PCS is Not Affected by Interconnect Prices

59. No economic reason exists to grant a subsidy to PCS by using a Bill and Keep approach because the future success of PCS is not affected by interconnect prices. First, note that numerous large corporations including AT&T, Sprint, AirTouch, and a number of the RBOCs have invested in buying PCS licenses in the FCC auction.[19] These companies have invested over $7 billion and are committed by their license terms to construct PCS networks. Thus, the entry decision has been made, and this decision will not be reversed unless a near catastrophic economic downturn occurs. As with almost all telecommunications services, PCS technology leads to relatively high fixed costs and relatively low marginal costs in operating a PCS network. The original entry decision will create significant economic incentives to expand output among PCS providers.

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[19] The RBOC purchases of PCS licenses are outside their home regions because these companies own Block B cellular spectrum in these home territories (with the exception of Pacific Telesis).

60. Initially, the main competition to PCS will be cellular. Indeed, in the UK the two PCS networks, Orange (Hutchinson) and Mercury, market their services directly in competition with cellular. The GSM technology used by PCS is very similar to the GSM technology used by digital cellular. While many US PCS providers may not choose the GSM approach, they are still very likely to offers digital mobile service quite similar to digital cellular service. The technology will not leave PCS at a competitive disadvantage to cellular. To the extent that the Commission adopts a common interconnection policy for CMRS providers as I recommended above, PCS will pay similar LRIC based interconnection charges just as cellular would pay. Thus, neither PCS nor cellular will be at a technology or regulatory advantage or disadvantage.

61. Furthermore, the results of the PCS Block A and Block B auctions, together with the bidding which has occurred to date for the Block C spectrum, demonstrates that informed market participants believe that PCS offer them the opportunity to achieve market returns in providing PCS service in competition with cellular.

VII. Adoption of Bill and Keep as an Interim Plan Would be Misguided Regulatory Policy

62. The NPRM recognizes some of the shortcomings of a Bill and Keep policy for PCS, but it nevertheless states that Bill and Keep may provide a reasonable interim plan. (¶ 59-60) I disagree with this conclusion. Bill and Keep creates significant economic distortions as I discussed above. Bill and keep does not represents a "close call" where the policy is almost "all right", e.g. the economic distortions and losses in economic efficiency are small. To the contrary, Bill and Keep represent a major wrong step in policy of creating yet another subsidy in a regulatory framework where participants have recognized for years that subsidies contribute a large part to many problems. The subsidy problem will only become more significant as